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Parental Education and Children's Schooling Outcomes: Is the Effect Nature, Nurture, or Both?

Evidence from Recomposed Families in Rwanda

Damien de Walque

ddewalque@worldbank.org

Development Research Group

The World Bank

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Abstract

Educated parents tend to have educated children. But is intergenerational transmission of human capital more nature, more nurture, or both? This paper uses household survey data from Rwanda that contains a large proportion of children living in households without their biological parents. The data should allow us to separate genetic from environmental parental influences. The non-random placement of children is controlled by including the educational attainment of the absent biological parents and the type of relationship that links the children to their "adoptive" families. The results of the analysis suggest that the nurture component of the intergenerational transmission of human capital is important for both parents, contrary to recent evidence proposed by Behrman and Rosenzweig (2002) and Plug (2004). They conclude that mothers' education had no environmental impact on children's schooling. Interestingly, mothers' education matters more for girls, while fathers' education is more important for boys. Finally, an important policy recommendation in the African context emerges from the analysis: the risk for orphans or abandoned children to lose ground in their schooling achievements is minimized if they are placed with relatives.

1. Introduction

The intergenerational transmission of human capital, and education in particular, is frequently examined through a nature versus nurture lens. We can observe that educated parents tend to have educated children, but it is not clear if this is due to common genetic traits passed from one generation to the next or to the ability of educated parents to provide a better learning environment for their children. The debate has crucial policy implications, since an environmental, rather than a purely genetic, relationship between parental and children's education would point to positive externalities attached to human capital investments.

Two recent papers by Behrman and Rosenzweig (2002) and Plug (2004) have revitalized this discussion by developing approaches to disentangle the nature and the nurture components of the intergenerational transmission of human capital. Their results suggest that, after isolating the genetic component, there was no environmental effect of mothers' schooling on children's education. This paper challenges their conclusions.

Three types of strategies have been used to separate nature and nurture components in the parent-child transmission of education. The first, pioneered by Taubman (1976), compares, as parents, genetically comparable twins with different schooling levels. This method is also used by Behrman and Rosenzweig (2002)[1]: using the twin-method, they find that a mother's education has a "marginally negative, rather than a significantly positive" effect on their children's schooling attainment.

The second method is instrumental variables: an exogenous variation in the schooling levels of the parents is used to identify the causal (environmental) effect of parents' schooling on children's education. Oreopoulos, Page, and Huff Stevens (2003) exploited historical changes in compulsory schooling laws in the United States and find a positive effect: parental education decreases the probability of grade repetition and drop-out. Chevalier (2004) using a similar approach in the United Kingdom also finds a positive effect of parental schooling on their children's education. But Black, Devereux, and Salvanes (2003) use reforms of the education system in Norway in the 1960s as an instrument and find no significant positive relationship between parental education and children's schooling, except in the mother-son relationship.

Comparing adoptive children with biological children is the third strategy. By looking at the outcome of adopted children, genetic effects will disappear leaving only the environmental effect. Sacerdote (2002) uses a British sample of adoptees and finds a positive and significant relationship of parental education on the education outcomes of their children. Björklund and Richardson (2001) find no significant effect among foreign-born adoptees in Sweden. Plug (2004) analyzes outcomes for adoptees from Wisconsin and reports that, when both parents' education is included in the regression, only the father's coefficient remains significantly positive, while the mother's loses its significance. Björklund, Lindahl, and Plug (2004), using data from Sweden, confirm the validity of the adoption strategy and find that

[1] Notice that Antonovics and Goldberger (2003) question the robustness of their results.

although there is a significant positive relationship between the schooling of adoptive parents and the academic attainment of their adopted children, the effects are smaller than in the case of biological families. Finally, Sacerdote (2004) uses data about Korean-American adoptees who, as infants, were randomly assigned to their families: he finds a positive effect of parental education on the child's schooling outcome, but that effect is much larger for biological children than for adoptees.

Although the legal concept of adoption cannot be easily transposed to the Rwandan context, this paper's approach is very similar to the adoption strategy. Rwanda may have one of the highest percentages of orphans in the world because of the 1994 Genocide and the HIV/AIDS epidemic. The United Nations estimates that 800,000 Rwandans (10 percent of the population) died between April and July 1994 (Des Forges, 1999; Siaens, Subbarao, and Wodon, 2003). HIV prevalence among adults in Rwanda was estimated at 5.1 percent at the end of 2003 (UNAIDS, 2004). Many of the children who lost their parents have been welcomed in new households, where they may or may not have relatives. This process of family recomposition is, in essence, very similar to adoption.

This study contributes to the nature-nurture literature by using data from the Enquête Intégrale sur les Conditions de Vie des Ménages (EICV) 1999-2001. This data set contains not only information about the new "adoptive" parents' education but also about the schooling levels of the biological parents.[2] In addition, the data also include information on the type of relationship (relative or not) between the "adopted" child and the head of the household. One of the main criticisms of the adoption strategy is that placement of adopted children might not be random: children left for adoption are placed in families with characteristics similar to their biological families. This is, of course, especially true in the case of adoption by relatives. The rich information contained in the EICV allows us to control for non-random placement and thus avoid this criticism.

In the main specification, the results indicate that, even after controlling for the schooling of the biological parents and the type of relationship linking the child and the head of his new household, the education of the most educated female adult in the new household has a positive and significant effect on the schooling of the child welcomed in the household. The magnitude of the effect is similar to the effect in a biological mother-child relationship. The effect of the education of the most educated male in the relationship is smaller than in a biological father-child relationship, but remains positive and significant. These results suggest that the nurture component of the intergenerational transmission of human capital is important, in particular for mothers, contrary to the evidence proposed by Behrman and Rosenzweig (2002) and Plug (2004). The analysis of interaction terms, however, indicates that these positive effects are only present for children related to the head of their new household (grandchildren and other relatives). When boys and girls are analyzed separately, it appears that, when the nurture component is isolated, the mother's education matters more for girls, while the father's education has a stronger effect on boy's educational achievement.

[2] To the best of my knowledge, only Björklund, Lindahl and Plug (2004) also use a data set containing information about the characteristics of the biological parents.

To the best of my knowledge, this is first study to disentangle nature and nurture effects in the intergenerational transmission of human capital in the context of a developing country. Family structures and the average schooling attainment of parents and children differ widely between developed and developing countries and therefore the transmission of human capital from one generation to the next might also work differently. Developing countries, in particular because of the large number of orphans produced by the HIV/AIDS epidemic and conflicts, are also in need of policy recommendations for organizing orphan care. The results from this paper suggest that maintaining an orphan in his extended family is beneficial and favors the transmission of human capital.

Section 2 of this paper describes the data and the Rwandan context. Section 3 presents the results of the empirical analysis together with several robustness tests. This section also discusses the external validity of the estimates. Section 4 concludes.

2. Recomposition in Rwandan Families after the Genocide and Data Description

This study uses data from the Enquête Intégrale sur les Conditions de Vie des Ménages (EICV) 1999-2001. This is a fairly standard survey that measures household living conditions. In urban areas the survey took place between October 1999 and December 2000, while rural areas were surveyed between July 2000 and July 2001 (Siaens, Subbarao and Wodon, 2003). Using this survey data Siaens, Subbarao and Wodon (2003) assess the vulnerability of orphans and conclude that they are more at risk in terms of school enrollment,[3] child labor, and malnutrition.

Figure 1 suggests how large the orphan population is in Rwanda. It plots, by age, the proportion of children living in households from which *both* biological parents are absent. For children over age 6, this proportion is consistently over 15 percent and reaches 22 percent for children aged 15. Not all of these children are orphans; the survey only indicates that their biological parents are not present in the household in which they live. However, Siaens, Subbarao and Wodon (2003) suggest that many of them *are* orphans. It appears, however, that many them are not necessarily orphans, or at least double orphans. Figure 1 also plots, from the 2000 Demographic and Health Survey for Rwanda, another nationally representative survey of Rwanda, the proportion of double orphans.[4] Starting with age 7[5], the proportion of double orphans is about one-half the proportion of children who are not living with both their

[3] Table 6, panel A, using regressions with household fixed effects for households where both biological and non-biological children live, confirms the finding that, controlling for age and gender, the latter are less likely to be enrolled in school than the former.

[4] Contrary to the EICV, the Demographic and Health Survey 2000 explicitly asked whether the biological parents were still alive.

[5] The analysis will focus on children 7 to 15 years of age. Notice in figure 1, the sharp increase, just before age 7, of the proportion of double orphans and the percentage of children living without both biological parents: this marks the effect of the Genocide which took place between April and July 1994. Given the difference in survey dates (June-November 2000 for the DHS and October 1999-July 2001 for the EICV) and the long span of the EICV, the discontinuity due to the Genocide might be less sharp than if I could have used exact date of births, which are not available in the EICV.

biological parents. Scenarios like children abandoned by their parents, placed in the household of relatives for fostering[6], or sent away to work as domestic employees explain why orphanhood, although being a major reason, is not the only cause behind the large proportion of children living without their biological parents. The data do not identify these reasons, except for children sent away as domestic employees.

For the purpose of this study, it is not necessary to know whether both biological parents of the child actually died. What *is* key is that those children are in an environment from which their biological parents are absent. That a substantial part of these absences are likely to be the consequences of killings during the Genocide is nevertheless important, since it establishes that many of the "adoptions" did not take place directly after birth. Placement of HIV/AIDS orphans would also, in most cases, take place several years after birth.

Table 1 reports summary statistics for most variables used in the analysis. Throughout the study, three different samples will be used: children living with both biological parents in their household, children with both biological parents absent but in a household with at least one adult male and one adult female and children with both biological parents absent but living in a household with a male head and a female spouse.

Children living with only one biological parent or children living without their biological parents but in a household without at least one adult male and one adult female are not studied.

Households including extensive families are common in Rwanda and therefore when a child who is without his biological parents is placed in a new family it is not always easy to determine the "adoptive" father and mother. This is why I have used two approaches to determine who should be considered as the "adoptive" parents. The first and more traditional approach is to consider the person designed as the head of the household as the "adoptive" father and to consider his spouse as the "adoptive" mother. This is the approach used in the three last columns of table 1 and in panels B of tables 3, 4 and 5. Under this approach, I will consider as parental education the education of the household's head and his wife.

There are two issues with this approach. First, it excludes children living with an adult brother and an adult sister, or children living with a grandmother and an uncle. It also, if there are several adults of each gender in the household, arbitrarily designates the "adoptive" parents. This is an issue in a country like Rwanda where, because the school infrastructure has been expanding gradually over time, educational attainment among adults is negatively associated with age, as illustrated in figure 2. If grandparents are designated as head of the household, they will therefore tend to have low schooling levels. But, this could, for example, not reflect the presence of younger and more educated relatives who can better follow the learning progress of the "adopted" child.

In order to avoid this pitfall, I suggest a second approach, which include all children with both biological parents absent but living in households with at least one adult male and one adult female. This is the approach followed in the three middle columns in table 1 and in

[6] Akresh (2003, 2004) studies this phenomenon in Burkina Faso.

panels A of table 3, 4 and 5. The data contained in panels B (household with a male head and his spouse) is a subset of the data in panels A (household with at least one adult male and one adult female). In the approach of panels A, the education of the most educated male and female is considered as the education of the adoptive father and mother, respectively. I think the strategy of panel A is the most logical in the absence of a clear marker of the "adoptive" parents, but I also offer the results from the approach in panel B, as an alternative specification.

The summary statistics displayed in table 1 indicate some differences between the three samples. The most important are that children living without their biological parents are more likely to live in urban areas and that the adults considered as their "adoptive" parents are on average more educated (in particular, and logically, when the most educated adults of both gender are considered as parents). The "adopted" children are also slightly older. These differences matters for the external validity of the results, which I will discuss later. For some children, the information about the education of their absent biological parent was not collected, so that when this variable is introduced in the analysis, the sample size will be reduced accordingly. Finally, the measure of economic well-being used in the analysis is the logarithm of household expenditures per adult equivalent, adjusted with an index for local prices.

3. The Effect of Parental Schooling on Children's Education

This section presents the empirical results obtained by using the "adoption" strategy: comparing children living with their biological parents with children living in household from which their biological parents are absent. Further, the internal and the external validity of the results is investigated and discussed.

3.1 Results of the "Adoption" Strategy

Table 2 contains the results from the sample of children 7 to 15 years of age living with their biological parents. Since some of the children are still attending school while some already dropped out of the educational system, the results are from censored regressions (Plug. 2004). The reported coefficient is the effect of one additional year of parental education on the schooling level of their child. All regressions control for the age of the child and the parents, the gender, and whether the location is rural or urban. Provincial ("prefectures") dummies are also included. The first two columns report coefficients when the father's and mother's schooling are entered separately in the regression. They are both positive and significant and of similar magnitudes, implying that one additional year of parental education increases their children's education by 0.3 years. When the education of both parents is entered jointly, as in column 3, the coefficients remain positive and significant, but their magnitude decreases by roughly one-third, indicating the presence of assortative matching (Plug, 2004): if entered separately, the father's and the mother's coefficients reflect not only the direct effect of the schooling of the parent under consideration, but also, indirectly, the effect of the other parent's education if there is a positive correlation between the educational attainment of both parents. Column 4 includes expenditures per adult equivalent in the

regression, with a positive and significant effect. The coefficients on parental years of education remain positive and significant, but their magnitude is slightly reduced, in particular for fathers. Columns 5 and 6 show a separate analysis for boys and girls. The magnitude of the coefficients is comparable across genders. Since table 2 analyzes the effect of biological parents' education, the estimates presented compound the nature and the nurture component of the intergenerational transmission of human capital.

Table 3 contains the results from the two samples of children who are living in households from which their biological parents are absent. As previously detailed, panel A includes the results for the approach when the most educated adult male and adult female are considered the "adoptive" parents, while panel B considers the head of the household and his spouse as the "adoptive" parents. Columns 1 to 4 have the same structure as in table 2[7]. In panel A, the coefficients on the schooling of the most educated adult male and female are positive and significant when entered separately. They are still significant (but only at the 10 percent confidence level for the most educated female) when entered jointly, but the significance is lower (only the coefficient for the most educated male is significant at the 10 percent level) when expenditures per adult equivalent are controlled. All coefficients are also smaller than among biological parents and children in table 2. In panel B, with a smaller sample, all coefficients are positive, but none is significant when they are entered jointly. Estimates from columns 1 to 4 do not account for the possibility of non-random placement of children in their new families.

Column 5 introduces as a control the type of relationship between the child and the head of the household.[8] Children are entered into four categories: grandchildren of the head of the household (the omitted dummy in the regression), other relatives, non-relatives, and domestic employees. Entering these variables matters in the regression: all the dummies are significant and clearly grandchildren are more likely to have better education outcomes, followed, in decreasing order, by other relatives, non-relatives, and domestics. The inclusion of these controls also affects the coefficient on the education of the "adoptive" parents. In both panel A and B, they are now positive and significant, and their magnitude is closer to the estimates for biological parents in table 2, in particular in the case of mothers in panel A. Controlling for the type of relationship between the child and the head of the household is one way to account for non-random placement of children in "adoptive" families: if children are placed with one of their relatives, placement is non-random, and similarly if they are placed as a domestic.

It is generally expected that non-random placement, because of a positive correlation between biological and adoptive parents' education, tend to bias upward the coefficient of intergenerational transmission of human capital in the adoption approach. Here, controlling for non-random placement by including the type of relationship between the child and his

[7] Notice however that in panel A it was not possible to control for the age of the most educated males and the most educated female, as in some cases, the highest schooling level was common to several individuals in the household.

[8] This is the case even in panel A, since the variable gives only the relationship with the head of the household and not with the adults having the highest schooling level.

"adoptive" family, actually increases the magnitude and the significance of these coefficients. It is probably due to the fact that ignoring the very strong link between type of relationship in the new family and schooling was obfuscating the actual mechanism of intergenerational transmission of human capital.

An additional way to control for non-random placement is to include the schooling level of the biological parents: if biological children from educated parents are placed in other families with high education levels, controlling for the biological parents' education will correct the bias. Since the EICV contains this information for most children—see the reduction is the sample size and therefore in power—this strategy is followed in column 6. This approach also suggests a very intuitive comparison between the nature and nurture components of the intergenerational transmission of human capital.[9] In panel A, both coefficients on the schooling of "adoptive" parents remain significant and their magnitude is comparable with column 5. In panel B, however, significance is only achieved for the male head of the household. What is striking about both panels is the strongly positive and significant coefficient on the education of the biological mother. Also very surprising the coefficient on the biological father's education; although positive, it is not significant[10].

It might be argued that including children identified as domestic employees of the household in the samples was not appropriate since it is clear that the family has no particular incentives to improve their schooling outcomes. Columns 7 and 8 acknowledge this by repeating columns 5 and 6 with samples from which all children employed as domestics workers have been removed. There is no changes in the significance of the coefficient on the education of "adoptive" parents, except that the coefficient for the male with the highest education in panel A is now only significant at the 10 percent confidence level, but the magnitude of most coefficients increases quite substantially. This is a sign that including domestic employees in the regressions might indeed have obfuscated some relationships.

Table 4 provides a separate analysis for boys and girls in order to investigate whether the mechanisms of intergenerational transmission of human capital are different across genders. The structure of the table and the regressions are similar to table 3. The regressions of columns 6 and 8 (without domestic employees) have been run separately for boys and girls. The results are very interesting and different than in table 2 among biological children when nature and nurture effect where confounded. Once the nurture component is isolated, for boys, the only significant coefficient are those on the "adoptive" father's education, while for girls, it is only the "adoptive" mother's education that seems to matter, at least in panel A, where it is significant. A similar conclusion can be reached by comparing the magnitudes of the coefficients: the "adoptive" father's education has a strong effect for boys, the "adoptive"

[9] This intuitive comparison is not valid, however, if adoption did not take place immediately after birth, which is often likely in Rwanda.

[10] One potential explanation would be that many of the "adoptions" occurred several years after birth. In that case, the coefficient for the biological parents includes both a genetic and an environmental effect (for the years prior to adoption). But, the years prior to "adoption" will tend to be the early childhood years, where the mother's impact is arguably more important that the father's impact. This would explain both the very strong effect for the biological mother and the non-significant effect for the biological father.

mother's schooling has a large impact on girls. Finally, the effect of the biological mother's education is only significant for girls, not for boys. These results suggest a strong specialization in the household: fathers follows the boys' education while mothers take care of the girls' progress in school.

In order to further analyze how the intergenerational transmission of human capital might vary according to the type of relationship that unites a child and his "adoptive" family, table 5 presents results where the schooling levels of the adoptive parents have been interacted with the type of relationship. The specifications are otherwise similar to columns 5 and 6 in table 3: panel A considers as "adoptive" parents the most educated adult male and female in the household while panel B considers the head of the household and his wife. Columns 1 and 3 do not include the biological parents' schooling while columns 2 and 4 do. In both panels, the coefficients on the "adoptive" parent's schooling are only significant if the child is a relative of the head of the household in which he has been welcomed. In panel A, the coefficient on the "adoptive" mother is significant and positive both if the child is a grandchild and an other relative, while, for the "adoptive" father it is only the case when the child is a an other relative, but not a grandchild. In panel B, the coefficient of intergenerational transmission of human capital between "adoptive" parents is only significant[11], for both parents, when children are relatives, but not grandchildren of the head of the household. The fact that there is no significant coefficient when the child is the grandchild of the head of the household suggests that the specification in panel B that considers as "adoptive" parents the head of the household might not be appropriate for the grandparent/ grandchild relationship, since the average education of grandparents is very low in Rwanda (see figure 2). I therefore tend to prefer the specification proposed in panel A of tables 3, 4 and 5.

The fact that there does not appear to be any intergenerational transmission of human capital when the "adopted" child is not a relative of his new family is of substantial importance in the Rwandan and more general African context confronted with high number of orphans. Together with the negative coefficient on the variables indicating that the child is not related to his new family (non-related and domestic), they strongly suggest that placing orphans with relatives is the preferred solution to minimize the detrimental impact on their educational achievements.

3.2 Internal and External Validity of the Estimates

Björklund, Lindahl and Plug (2004) suggest three reasons to question the internal validity of estimates derived from the adoption strategy, as well as three reasons for scrutinizing their external validity.

The first possible bias in the estimates that would jeopardize the internal validity is non-random placement of the adopted child in the adoptive family. The whole point of the adoption strategy is to exploit adoption as a "break" between nature and nurture in order to be

[11] Significance is lost, however, for the wife of the household head, when the schooling of the biological parents is controlled.

able to disentangle genetic and environmental effects. But if the placement of the adoptive child is not random, then the break is not as clean and estimates will be biased. I believe, however, that using the data from the EICV that include information both about the type of relationship between the child and his new family and about the education of the biological parents can control for non-random placement and remove the bias associated with it.

The adoption strategy also, implicitly, assumes that adoption occurs just after birth, so that all the environmental effects can be attributed to the adoptive parents. In the current study, there is no way to know when the "adoption" occurred, but it can be assumed that in most cases adoption did not occur immediately after birth. Indeed, as suggested by the higher orphanhood rates for children born before 1994 in figure 1, many of the children might have lost their biological parents during the Genocide in 1994. HIV/AIDS orphans are also not very likely to have lost their parents immediately after birth. Although the duration is difficult to estimate for each child, it is likely that many children lived for some years with their biological parents before being placed in a new household. In that case, the environmental effect should be assigned both to the biological parents, for the first pre-adoption years, and to the "adoptive" parents for the subsequent years. In that situation, in a regression including both the schooling levels of biological and "adoptive" parents, the nature component, if represented by the coefficient for the biological parents, would be upwardly biased, while the nurture component, if represented by the coefficient for "adoptive" parents would be downwardly biased. Since most of the coefficients on the education of "adoptive" parents are nevertheless positive and significant, despite this potential downward bias, it actually reinforces the conclusion from this study that there is a nurture component in the intergenerational transmission of human capital.

The third objection to the internal validity of estimates derived from the adoption strategy is self-selection. If the same individuals who have a taste (or a discount factor) such that they like education for themselves are also the ones who are the most likely to provide a good learning environment for their children, then parental education is not causal in improving their children's schooling outcomes. The adoption strategy does not remove this potential source of bias.

The first objection to the external validity of the results of this study is clear: the type of household structure, the average schooling levels of parents and children are very different in the African context than in developed countries where the adoption strategy has usually been implemented. One hypothesis that would reconcile the results of this study with the conclusions of Behrman and Rosenzweig (2002) and Plug (2004) that there is no environmental effect of mothers' education would be that the mother's education might matter during the first years at school, which are still the relevant margin for most children in Africa, while it might be less crucial for high school or college graduation, which are the margins of interest in developed countries.[12] Moreover, even if estimates from the adoption strategy are unbiased, they might be peculiar to the relationship between adoptive parents and

[12] However, it is generally recognized that the first school years have a large impact on subsequent academic achievement.

adopted child and, as such, could not be fully transposed to the more general parent-child relationship, even in the Rwandan context.

Björklund, Lindahl, and Plug (2004) suggest three grounds to question the external validity of the adoption strategy: (1) parents might treat biological and non-biological children differently, (2) adoptive parents might not be average parents, and (3) adoptive children might not be average children.

The fact that the type of relationship linking the "adopted" child with his "adoptive" family is very significant in all regressions and that the more distant the relationship the worse the schooling of the child already suggests differential treatment. This appears to be an instance of Hamilton's rule that investment in the human capital of a child decreases with the distance between the child and the head of the household (Case, Paxson, and Ableidinger, 2004). Panel A of table 6 presents regressions, with household fixed effects, of schooling enrollment of the children by age, gender and the type of relationship with the head of the household for the sample of all children, biological and adoptive, living in households where both biological and non-biological children are present. The results are consistent with those in Case, Paxson, and Ableidinger (2004) for other African countries: within the same household, non-biological children have lower educational achievements than biological children. And Hamilton's rule seems to apply quite exactly: grandchildren and other relatives fare worse than biological children, non-relatives fare worse than relatives and domestic employees fare worse than any other category[13].

By using household fixed effects, the regressions in panel A of table 6 exclude any effect due to differences in types of household and the types of parents between adoptive families and non-adoptive families. However, the fact that non-biological children are worse off could be due either to a differential treatment by the parents (discrimination) or to the fact that "adopted" children are not average children, because, at least a substantial part of them have been exposed to the shock of losing their parents, potentially during the Genocide. But since Hamilton's rule seems to apply quite precisely, this points rather in the direction of discrimination as a function of distance from the head of the household.[14] However, finding a positive and significant coefficient for the environmental component of the intergenerational

[13] Another explanation can be advanced for the lower educational achievement of adoptees who are not relatives of the head of the household. After the 1994 Genocide, orphans who could not be placed with relatives were placed in government or private-not-for profit (mainly religious) orphanages. In 1998, the policy changed: orphanages were closed and those children were sent in foster families. If the orphanages had a detrimental effect on educational attainment (this is by no means established, as some of the orphanages were well funded by foreign charities) during the 1994-1998 period, and since non-relative adoptees are probably more likely to have stayed in an orphanage, their lower educational achievement might be due to their past in the orphanage rather than current discrimination from their adoptive family. The EICV which has no data about past family arrangements of the children, does not allow to test this alternative explanation. I tend to prefer Hamilton's rule since it has been established by Case, Paxson, and Ableidinger (2004) for other African countries where no such policy change occurred.

[14] Unless "adopted" children who are relatives of the head of the household are less likely to be orphans, for some reason. Since the data does not say whether the child is actually an orphan and if not, why he is not living with his biological parents, it is impossible to investigate this issue.

transmission of human capital even among children who seem to be discriminated against could suggest that the nurture component is even stronger among biological children.

Parents who decide to welcome non-biological children in their household might also not be average parents. This is especially true in the Rwandan context, in the case of the adoption by relatives. The adoption of relatives might indicate that those parents belong to extended families disproportionately hit by the Genocide or by the HIV/AIDS epidemic. The summary statistics in table 1 also indicate that "adoptive" parents tend to be more educated and are more likely to live in cities than biological parents. The panel B of table 6 implements a test, inspired by Björklund, Lindahl and Plug (2004). It compares biological children in households having no non-biological children (sub-panel 1) with biological children in families having also some non-biological children. Differences in the coefficients between both subsamples would indicate that "adoptive" parents might be different. The results are somewhat mixed as the coefficient on the father's education is higher in sub-panel 2 than in subpanel 1, while the coefficient on mother's education in subpanel 2 is not significant and smaller than in subpanel 1. The small sample size for subpanel 2 should be kept in mind.

Finally, children who are not living with their biological parents might be different from the average child. This is obviously true when those children are orphans, and a fortiori if they lost their parents in a very violent conflict like the 1994 Genocide in Rwanda. There is no specific feature in the data to test for this, but given the Rwandan context[15], it is very likely that this aspect of the external validity is not satisfied. One might conjecture that children who have lost their biological parents in violent conflicts have experienced a shock that would make them less receptive to education and that this would tend to attenuate the coefficient of intergenerational transmission of human capital. Finding a positive and significant coefficient even among those children would then suggest that the nurture component is even stronger among average children.

It remains, however, that the external validity of the estimates of this paper can legitimately be questioned, on the ground that children who lost their parents during the Genocide are not average children, that relatives who welcome them in their household are not average parents and that, following Hamilton's rule, children more distant from the head of the household appear to experience discrimination. Nevertheless, given the large number, in Africa and in other developing countries, of children orphaned by conflicts or by the HIV/AIDS epidemic, it is very relevant, in order to orient policy, to know how human capital is transmitted from adoptive parents to adopted children.

4. Conclusions

This paper attempts to separate the nature and nurture components in the intergenerational transmission of human capital. It applies an adoption strategy that exploits adoption as a break between the genetic and the environmental influences that parents have on

[15] See above the discussion of figure 1: about 50 percent of the children aged 7 and above who are not living with their biological are double orphans. The data does not address reasons why the other 50 percent are not living with their parents.

their children's schooling outcomes. It does so by analyzing a household survey from Rwanda, the EICV, that contains, in part because of the 1994 Genocide and the HIV/AIDS epidemic, a very large proportion of children living in households from which their biological parents are absent. The data also contain information about the type of relationship that links the children to their "adoptive" families and about the educational attainment of the absent biological parents. These two features control for non-random placement of the "adoptees," one of the main sources of bias in using the adoption strategy.

The results of the analysis suggest that the nurture component of the intergenerational transmission of human capital is important, in particular for mothers, contrary to recent evidence proposed by Behrman and Rosenzweig (2002) and Plug (2004). In the preferred specification, even after controlling for non-random placement by including the schooling of the biological parents and the type of relationship linking the child and the head of his new household, the education of the most educated female adult in the new household has a positive and significant effect on the schooling of the child welcomed in the household. The magnitude of the effect is similar to the effect in a biological mother-child relationship.[16] The effect of the education of the most educated male in the relationship is smaller than in a biological father-child relationship, but remains positive and significant. When boys and girls are analyzed separately, it appears that, when the nurture component is isolated, the mother's education matters more for girls, while the father's education has a stronger effect on boys' educational achievement. The analysis of interaction terms indicates that the positive effects of the education of the "adoptive" parents are only present for children related to the head of their new household (grandchildren and other relatives).

The external validity of this study might be questioned since it is difficult to argue that children being "adopted" into recomposed households in the years following the Genocide in Rwanda are representative of the general parent-child relationship. In addition, non-biological children seem to be discriminated against, according to Hamilton's rule, where the children most distant from the household head are worse off. However, given the rising numbers of orphans from conflicts and from the HIV/AIDS epidemic in Africa and elsewhere, the analysis offers important policy lessons. In particular, the study demonstrates that placing orphans in households where they have relatives minimizes their educational losses and favors the intergenerational transmission of human capital.

[16] Björklund, Lindahl and Plug (2004), using data from Sweden, find a positive and significant effect of the adoptive mother's schooling, but with a smaller magnitude than in biological families. Sacerdote (2004) comes to a similar conclusion with a sample of Korean-American adoptees.

Bibliography

The word "processed" describes informally reproduced works that may not be commonly available through library systems.

Ainsworth, Martha and Deon Filmer. 2002. "Poverty, AIDS and Children's Schooling: A Targeting Dilemma." Policy Research Working Paper 2885. The World Bank. Washington, D.C.

Akresh, Richard. 2003. "Risk, Network Quality, and Family Structure: Child Fostering Decisions in Burkina Faso." Processed.

Akresh, Richard. 2004. "Adjusting Household Structure: School Enrollment Impacts of Child Fostering in Burkina Faso." Processed.

Antonovics, Kate, and Arthur Goldberger. 2003. "Do Educated Mothers Make Bad Mothers?" Twin Studies and the Intergenerational Transmission of Human Capital. Processed.

Behrman, Jere, and Mark Rosenzweig. 2002. "Does Increasing Women's Schooling Raise the Schooling of the Next Generation." *American Economic Review* 92(1): 323-34.

Black, Sandra, Paul J. Devereux, and Kjell G. Salvanes. 2003. "Why the Apple Doesn't Fall Far: Understanding Intergenerational Transmission of Human Capital." National Bureau of Economic Research Working Paper No. 10066. Cambridge, Massachusetts.

Björklund, Anders, Mikael Lindahl, and Erik Plug. 2004. "Intergenerational Effects in Sweden: What Can We Learn from Adoption Data?" IZA Discussion Paper No. 1194. Institute for the Study of Labor, Bonn, Germany.

Björklund, Anders, and Katarina Richardson. 2001. "The Educational Attainment of Adopted Children Born Abroad." Processed.

Case, Anne, I-Fen Lin, and Sara McLanahan. 2000. "How Hungry is the Selfish Gene?" *Economic Journal* 110 (466): 781-804.

Case, Anne, Christina Paxson, and Joseph Ableidinger. 2004. "Orphans in Africa: Parental Death, Poverty and School Enrollment." *Demography* 41(3): 483-508.

Chevalier, Arnaud. 2004. "Parental Education and Child's Education?" IZA Discussion Paper No. 1153. Institute for the Study of Labor, Bonn, Germany.

Des Forges, Alison. 1999. *Leave None to Tell the Story: Genocide in Rwanda*. Human Rights Watch, New York.

Evans, David and Edward Miguel. 2004. "Orphans and Schooling in Africa: A Longitudinal Analysis." Processed.

Gertler, Paul, David Levine, and Sebastian Martinez. 2003. "The Presence and Presents of Parents: Do Parents Matter for More Than Their Money?" Processed.

Mulligan, Casey B. 1997. *Parental Priorities and Economic Inequality*. University of Chicago Press, Chicago and London.

Oreopoulos, Philip, Marianne E. Page, and Anne Huff Stevens. 2003. "Does Human Capital Transfer from Parent to Child? The Intergenerational Effects of Compulsory

Schooling." National Bureau of Economic Research Working Paper No. 10164. Cambridge, Massachusetts.

Plug, Erik. 2004. "Estimating the Effect of Mother's Schooling on Children's Schooling Using a Sample of Adoptees." *American Economic Review* 94(1): 358-68.

Plug, Erik and Wim Vijverberg. 2003. "Schooling, Family Background, and Adoption: Is It Nature or Is It Nurture? *Journal of Political Economy* 111(3): 611-41.

Rwanda Government and ORC Macro. 2001. *Enquête Démographique et de Santé, Rwanda 2000.* Ministère de la Santé, Office National de la Population. Kigali, Rwanda.

Sacerdote, Bruce. 2002. "The Nature and Nurture of Economic Outcomes." *American Economic Review Papers and Proceedings* 92(May 2002): 344-48.

Sacerdote, Bruce. 2004. "What Happens When We Randomly Assign Children to Families?" National Bureau of Economic Research Working Paper No. 10894. Cambridge, Massachusetts.

Siaens, Corinne, K. Subbarao, and Quentin Wodon. 2003. "Are Orphans Especially Vulnerable? Evidence from Rwanda." World Bank. Washington, D.C. Processed.

Taubman, Paul. 1976. "The Determinants of Earnings: genetics, Family, and Other Environments: A Study of White Male Twins." *American Economic Review* 66(5): 858-70.

UNAIDS. 2004. "Epidemiological Fact Sheets on HIV/AIDS and Sexually Transmitted Infections. Rwanda." Processed.

Verwimp, Philip. 2003a. "The Political Economy of Coffee, Dictatorship and Genocide." *European Journal of Political Economy* 19: 161-81.

Verwimp, Philip. 2003b. "Testing the Double Genocide Thesis for Central and Southern Rwanda." *Journal of Conflict Resolution* 47: 423-42.

Verwimp, Philip. 2004a. "Death and Survival during the 1994 Genocide in Rwanda." *Population Studies* 58: 233-45.

Verwimp, Philip. 2004b. "An Economic Profile of Peasant Perpetrators of Genocide." *Journal of Development Economics*. Forthcoming.

Figure 1. Proportion of children with both biological parents absent from the household and proportion of double orphans, by age. Enquete Integrale sur les Conditions de Vie des Menages, Rwanda 1999-2001 and Rwanda Demographic and Health Survey, 6-11/2000

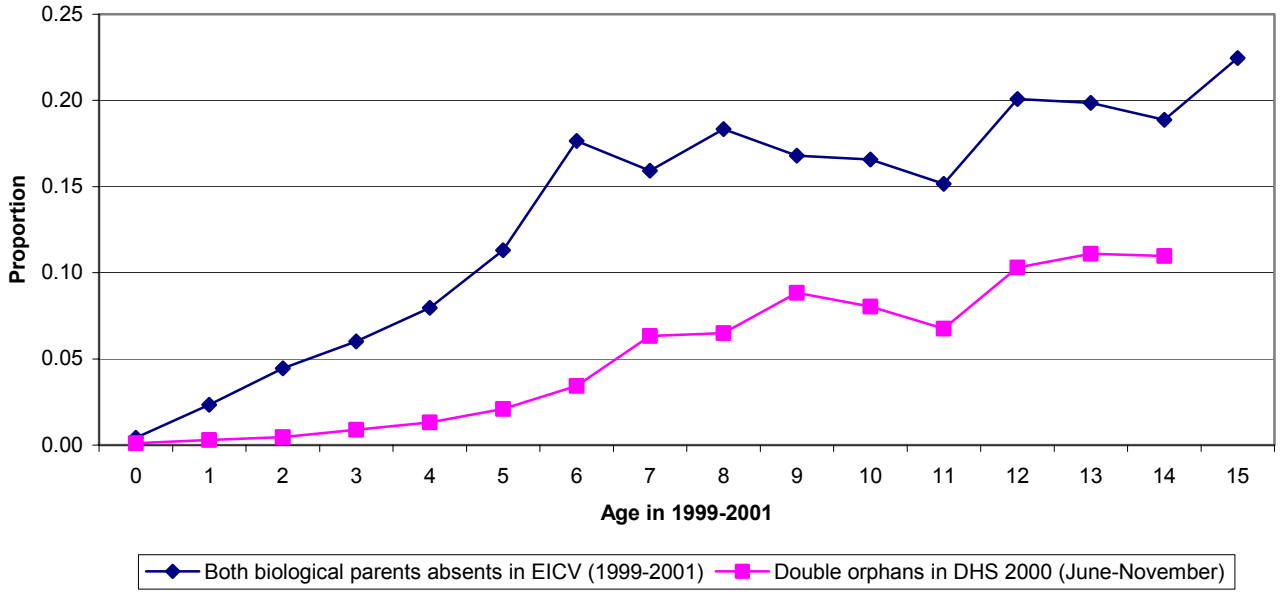

Figure 2. Average years of education of adults, by age and gender
Enquete Integrale sur les Conditions de Vie des Menages, Rwanda 1999-2001

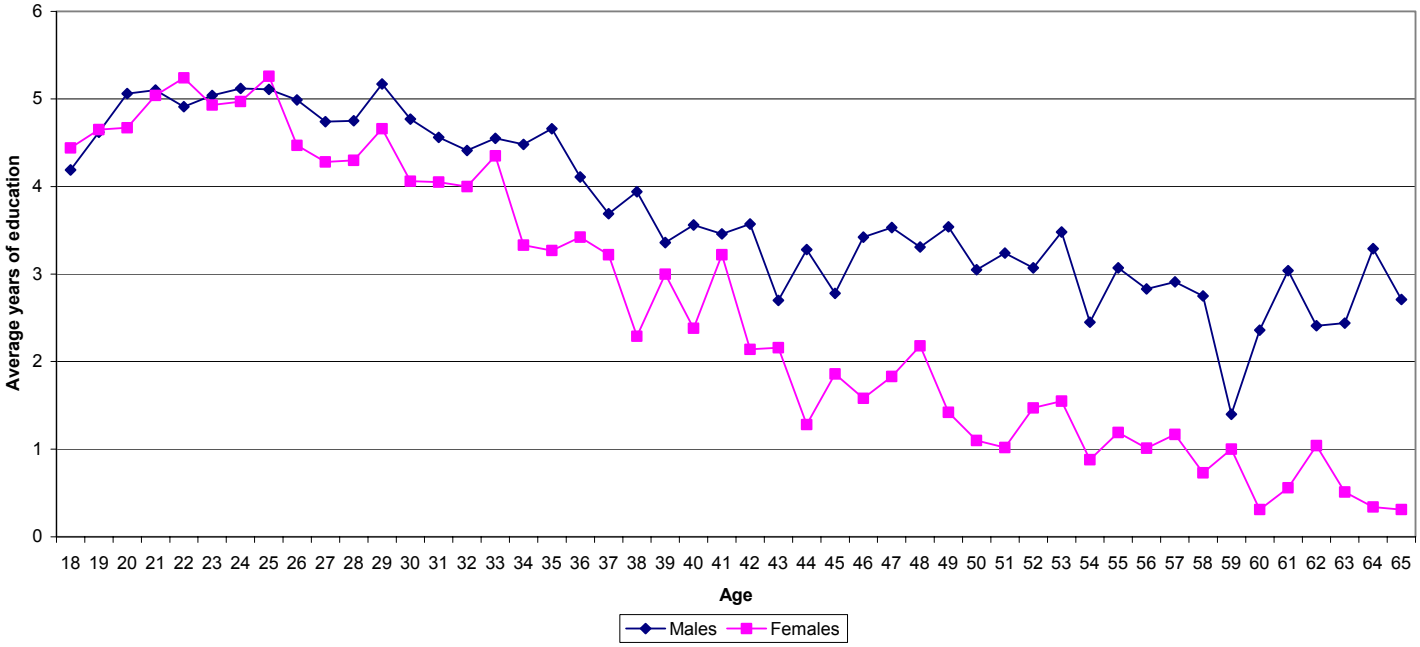

Table 1. Summary Statistics, Children Aged 7 to 15

Variable	*Both biological parents in household*			*Both biological parents absent from household but in household with at least one adult male and one adult female*			*Both biological parents absent from household, but in household with a male head and a female spouse*		
	Mean	St. err.	N =	Mean	St. err.	N =	Mean	St. err.	N =
Age	10.96	0.04	3993	11.41	0.08	1053	11.51	0.09	763
Male	0.489	0.008	3993	0.454	0.015	1053	0.456	0.018	763
Rural	0.93	0.004	3993	0.808	0.012	1053	0.823	0.013	763
Log expenditures per adult equivalent	10.763	0.011	3993	11.2	0.025	1053	11.22	0.029	763
Grand child	n.a.	n.a.	n.a.	0.317	0.014	1053	0.275	0.016	763
Other relative	n.a.	n.a.	n.a.	0.471	0.015	1053	0.493	0.018	763
Non-related	n.a.	n.a.	n.a.	0.104	0.009	1053	0.106	0.011	763
Domestic	n.a.	n.a.	n.a.	0.091	0.008	1053	0.109	0.011	763
Years of education biological father	3.172	0.048	3993	2.798	0.118	820	2.555	0.132	599
Years of education biological mother	2.371	0.047	3993	2.094	0.102	820	1.793	0.112	599
Years of education of most educated adult male	n.a.	n.a.	n.a.	5.464	0.121	1053	n.a.	n.a.	n.a.
Years of education of most educated adult female	n.a.	n.a.	n.a.	5.563	0.106	1053	n.a.	n.a.	n.a.
Years of education of head of household (male)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4.492	0.14	763
Years of education of spouse (female)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.636	0.137	763
Years of education of child	2.22	0.0281	3993	2.25	0.057	1053	2.19	0.065	763
Years of education children age 7	0.473	0.0286	471	0.766	0.058	85	0.727	0.066	58
Years of education children age 8	0.942	0.035	429	1.016	0.07	97	0.982	0.083	69
Years of education children age 9	1.309	0.0418	401	1.508	0.086	95	1.519	0.092	67
Years of education children age 10	1.764	0.049	531	1.848	0.11	124	1.757	0.122	83
Years of education children age 11	2.232	0.06	417	1.9	0.153	80	1.827	0.182	57
Years of education children age 12	2.766	0.074	455	2.264	0.16	125	2.163	0.176	89
Years of education children age 13	3.055	0.074	443	2.852	0.17	132	2.694	0.184	105
Years of education children age 14	3.592	0.088	451	3.418	0.182	132	3.24	0.201	105
Years of education children age 15	4.01	0.102	395	3.39	0.17	183	3.293	0.199	130

n.a. Not applicable.

Note: The data are weighted as recommended by the data provider.

Source: Enquête Intégrale sur les Conditions de Vie des Ménages, Rwanda 1999-2001.

Table 2. The Effect of Parental Education On Children's Schooling When Both Biological Parents Are Present in the Household, Children Aged 7 To 15

Dependent variable: child's years of education					*Boys only*	*Girls only*
	[1]	[2]	[3]	[4]	[5]	[6]
Years of education of biological father	0.286	_	0.213	0.153	0.141	0.165
	[0.029]***		[0.030]***	[0.030]***	[0.039]***	[0.039]***
Years of education of biological mother	_	0.305	0.22	0.174	0.187	0.16
		[0.030]***	[0.031]***	[0.030]***	[0.039]***	[0.039]***
Log expenditures per adult equivalent	_	_	_	0.978	0.899	1.039
				[0.126]***	[0.164]***	[0.162]***
Observations	3,993	3,993	3,993	3,993	1,940	2,053

Robust standard errors, clustered at the household level are between brackets.

*, **, ***: significant at the 10-percent, 5-percent and 1-percent level, respectively.

_ : variable not entered in the regression.

Note: The data are weighted as recommended by the data provider. Expenditures per adult equivalent are adjusted with a local price index. Censored regressions. All regressions include age of the child, gender, rural and prefecture dummies as well as a control for the age of the parent(s).

Source: Enquête Intégrale sur les Conditions de Vie des Ménages, Rwanda 1999-2001.

Table 3. The Effect of Parental Education On Children's Schooling When Both Biological Parents Are Absent from the Household, Children Aged 7 To 15

Dependent variable: child's years of education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Both biological parents absent from household, but in household with at least one adult male and one adult female								
Years of education of most educated adult male	0.128	_	0.088	0.078	0.125	0.106	0.149	0.117
	[0.040]***		[0.041]**	[0.042]*	[0.040]***	[0.051]**	[0.046]***	[0.061]*
Years of education of most educated adult female	_	0.145	0.1	0.092	0.174	0.172	0.225	0.253
		[0.056]***	[0.060]*	[0.063]	[0.054]***	[0.067]***	[0.063]***	[0.091]**
Years of education of biological father	_	_	_	_	_	0.095	_	0.062
						[0.060]		[0.067]
Years of education of biological mother	_	_	_	_	_	0.191	_	0.189
						[0.075]**		[0.091]**
Other relative	_	_	_	_	-1.181	-1.03	-1.367	-1.227
					[0.351]***	[0.414]**	[0.371]***	[0.455]***
Non-related	_	_	_	_	-3.169	-2.835	-3.583	-3.347
					[0.440]***	[0.540]***	[0.456]***	[0.557]***
Domestic	_	_	_	_	-5.183	-4.675	_	_
					[0.536]***	[0.609]***		
Log expenditures per adult equivalent	_	_	_	0.165	0.469	0.309	0.458	0.288
				[0.282]	[0.249]*	[0.290]	[0.283]	[0.315]
Observations	1,053	1,053	1,053	1,053	1,053	820	938	739
B. Both biological parents absent from household, but in household with a male head and a female spouse								
Years of education head of household (male)	0.124	_	0.082	0.078	0.14	0.127	0.18	0.147
	[0.050]**		[0.053]	[0.056]	[0.051]***	[0.061]**	[0.061]***	[0.073]**
Years of education of spouse (female)	_	0.144	0.1	0.096	0.133	0.11	0.177	0.141
		[0.058]**	[0.065]	[0.070]	[0.068]**	[0.082]	[0.089]**	[0.113]
Years of education of biological father	_	_	_	_	_	0.069	_	0.037
						[0.066]		[0.071]
Years of education of biological mother	_	_	_	_	_	0.298	_	0.322
						[0.083]***		[0.097]***
Other relative	_	_	_	_	-1.258	-0.897	-1.394	-0.878
					[0.683]*	[0.748]	[0.801]*	[0.891]
Non-related	_	_	_	_	-3.125	-2.517	-3.544	-2.789
					[0.705]***	[0.796]***	[0.805]***	[0.906]***
Domestic	_	_	_	_	-4.953	-4.018	_	_
Log expenditures per adult equivalent	_	_	_	0.064	0.334	0.088	0.301	0.052
				[0.342]	[0.292]	[0.343]	[0.351]	[0.427]
Observations	763	763	763	763	763	599	665	529

The data are weighted as recommended by the data provider.
Robust standard errors, clustered at the household level are between brackets.
*, **, ***: significant at the 10-percent, 5-percent and 1-percent level, respectively.
_ : variable not entered in the regression.
Note: Censored regressions. All regressions include age, gender, rural and prefecture dummies. In columns (7) and (8) children identified as domestics are excluded. Expenditures per adult equivalent are adjusted with a local price index. The omitted dummy for the type of relationship is grandchild. In panel B only, age of the head of household and the spouse are entered as a control.
Source: Enquête Intégrale sur les Conditions de Vie des Ménages, Rwanda 1999-2001.

Table 4. The Effect of Parental Education On Children's Schooling When Both Biological Parents Are Absent from the Household, Children Aged 7 To 15

Dependent variable: child's years of education	*BOYS*		*GIRLS*	
	(1)	(2)	(3)	(4)
A. Both biological parents absent from household, but in household with at least one adult male and one adult female				
Years of education of most educated adult male	0.145	0.182	0.036	0.043
	[0.070]**	[0.077]**	[0.055]	[0.061]
Years of education of most educated adult female	0.044	0.12	0.304	0.34
	[0.075]	[0.077]	[0.091]***	[0.110]***
Years of education of biological father	0.083	0.02	0.09	0.113
	[0.074]	[0.071]	[0.077]	[0.084]
Years of education of biological mother	0.134	0.039	0.252	0.276
	[0.098]	[0.096]	[0.095]***	[0.105]***
Other relative	-1.6	-1.894	-0.777	-0.897
	[0.561]**	[0.556]***	[0.561]	[0.585]
Non-related	-2.526	-3.269	-3.293	-3.61
	[0.821]***	[0.781]***	[0.700]***	[0.759]***
Domestic	-4.563	_	-4.602	_
	[0.803]***		[0.810]***	
Log expenditures per adult equivalent	-0.046	-0.044	0.365	0.248
	[0.389]	[0.399]	[0.356]	[0.395]
Observations	373	333	447	406
B. Both biological parents absent from household, but in household with a male head and a female spouse				
Years of education head of household (male)	0.127	0.275	0.056	0.07
	[0.061]**	[0.101]***	[0.079]	[0.092]
Years of education of spouse (female)	0.11	0.096	0.148	0.171
	[0.082]	[0.091]	[0.132]	[0.170]
Years of education of biological father	0.082	0.015	0.078	0.105
	[0.082]	[0.082]	[0.077]	[0.083]
Years of education of biological mother	0.139	0.076	0.407	0.438
	[0.099]	[0.100]	[0.115]***	[0.126]***
Other relative	-2.76	-2.965	0.261	0.446
	[0.776]***	[0.826]	[1.141]	[1.193]
Non-related	-3.383	-4.07	-1.879	-1.82
	[0.973]***	[1.013]***	[1.153]	[1.260]
Domestic	-5.32	_	-2.867	_
	[0.885]***		[1.437]**	
Log expenditures per adult equivalent	-0.383	-0.204	0.295	0.111
	[0.445]	[0.473]	[0.436]	[0.534]
Observations	272	237	327	292

Robust standard errors, clustered at the household level are between brackets.
The data are weighted as recommended by the data provider.
*, **, ***: significant at the 10-percent, 5-percent and 1-percent level, respectively.
Note: Censored regressions. All regressions include age, rural and prefecture dummies. In columns (2) and (4) children identified as domestics are excluded. Expenditures per adult equivalent are adjusted with a local price index. The omitted dummy for the type of relationship is grand child. In panel B only, age of the head of household and the spouse are entered as a control.
Source: Enquête Intégrale sur les Conditions de Vie des Ménages, Rwanda 1999-2001.

Table 5. The Effect of Parental Education on Children's Schooling When Both Biological Parents Are Absent from the Household, Children Aged 7 To 15

Dependent variable: child's years of education

A. Both biological parents absent from household but in household with at least one adult male and one adult female			**B. Both biological parents absent from household, but in household with a male head and a female spouse**		
	(1)	(2)		(3)	(4)
Years of education of most educated adult male * grand child	0.061	-0.012	Years of education head of household (male) * grand child	-0.016	-0.075
	[0.069]	[0.079]		[0.123]	[0.135]
Years of education of most educated adult male * other relative	0.199	0.197	Years of education head of household (male) * other relative	0.247	0.203
	[0.058]***	[0.063]***		[0.070]***	[0.082]**
Years of education of most educated adult male * non-related	0.113	0.11	Years of education head of household (male) * non-related	0.103	0.088
	[0.088]	[0.093]		[0.086]	[0.084]
Years of education of most educated adult male * domestic	0.07	0.079	Years of education head of household (male)* domestic	0.007	0.052
	[0.076]	[0.086]		[0.102]	[0.126]
Years of education of most educated adult female * grand child	0.281	0.272	Years of education of spouse (female) * grand child	0.088	-0.096
	[0.099]***	[0.124]**		[0.294]	[0.243]
Years of education of most educated adult female * other relative	0.237	0.234	Years of education of spouse (female) * other relative	0.196	0.17
	[0.084]***	[0.090]***		[0.094]**	[0.110]
Years of education of most educated adult female * non-related	0.038	0.035	Years of education of spouse (female) * non-related	0.025	-0.027
	[0.112]	[0.102]		[0.097]	[0.098]
Years of education of most educated adult female * domestic	-0.049	-0.037	Years of education of spouse (female) * domestic	0.112	0.111
	[0.097]	[0.120]		[0.115]	[0.135]
Years of education of biological father	_	0.068	Years of education of biological father	_	0.072
		[0.054]			[0.058]
Years of education of biological mother	_	0.192	Years of education of biological mother	_	0.287
		[0.069]***			[0.083]***
Other relative	-1.683	-1.85	Other relative	-2.215	-1.876
	[0.627]***	[0.694]***		[0.789]***	[0.861]**
Non-related	-1.992	-1.823	Non-related	-2.622	-2.048
	[0.968]**	[1.111]		[0.904]***	[1.047]*
Domestic	-2.608	-2.972	Domestic	-4.006	-3.85
	[0.947]***	[1.100]***		[1.153]***	[1.218]***
Log expenditures per adult equivalent	0.369	0.19	Log expenditures per adult equivalent	0.237	0.067
	[0.241]	[0.280]		[0.287]	[0.341]
Observations	1,053	820	Observations	763	599

Robust standard errors, clustered at the household level are between brackets.
*, **, ***: significant at the 10-percent, 5-percent and 1-percent level, respectively.
_ : variable not entered in the regression.
Note: Interactions between parental education and type of relationship. Censored regressions. All regressions include age, gender, rural and prefecture dummies. The data are weighted as recommended by the data provider. Expenditures per adult equivalent are adjusted with a local price index. In panel B only, age of the head of household and the spouse are entered as a control.
Source: Enquête Intégrale sur les Conditions de Vie des Ménages, Rwanda 1999-2001.

Table 6. Tests of the External Validity of the Estimation Strategy, Children Aged 7 to 15

Dependent variable: child's years of education

A. School enrollment of children living in household with both biological and non-biological children. With household fixed effects.

Male	0.001	Male	-0.005
	[0.030]		[0.033]
Grandchild	-0.179	Non-biological child	-0.303
	[0.072]**		[0.034]***
Other Family	-0.173		_
	[0.042]***		
Non-related	-0.413		_
	[0.066]***		
Domestic	-0.875		_
	[0.065]***		
Observations	1,178		1,178

Standard errors are between brackets.
*, **, ***: significant at the 10-percent, 5-percent and 1-percent level, respectively.
_ : variable not entered in the regression.
Note: Linear regression with household fixed effects, including age dummies. The omitted dummy is biological child.

B. Testing whether parents welcoming non-biological children are different parents?

	(1) Biological children in families with no non-biological children	(2) Biological children in families with also some non-biological children
Father's years of education	0.135	0.27
	[0.030]***	[0.116]**
Mother's years of education	0.173	0.096
	[0.031]***	[0.115]
Observations	3,476	517

The data are weighted as recommended by the data provider.
Robust standard errors, clustered at the household level are between brackets.
*, **, ***: significant at the 10-percent, 5-percent and 1-percent level, respectively.
Note: Censored regressions. The specifications are the same as in table 2 for panel B. Age, gender, rural, prefecture dummies and the log expenditures per adult equivalent, adjusted with a local price index are included. The age of the parents are entered as a control.
Source: Enquête Intégrale sur les Conditions de Vie des Ménages, Rwanda 1999-2001.